ASCI UPDATE
December 2000

Awards and Accomplishments

Stephen Attaway
Computational Solid Mechanics &
Structural Dynamics
Sandia National Laboratories

The Sidney Fernbach Award

"For pioneering advances in methods for modeling transient dynamics phenomena, enabling simulations of unprecedented scale and fidelity," Stephen Attaway, of Computational Solid Mechanics & Structural Dynamics at Sandia National Laboratories, was awarded the 2000 Sidney Fernbach Award from the IEEE Computer Society at the SC2000 conference in Dallas, Texas in November.

The Sidney Fernbach Memorial Award was established in 1992 by the IEEE Computer Society in memory of Sidney Fernbach, a pioneer in the development and application of high-performance computers. A certificate and $2,000 are awarded for outstanding contributions in the application of high-performance computers using innovative approaches.

Steve is an engineer who works in computational mechanics for crash and impacts and is the first Sandian to win this award. “The effort in parallel contact for finite element codes was a research area where many people said, ‘It cannot be done, parallel computing will not work for finite element contact problems,’” he says. “Sandia showed that parallel contacts were indeed a solvable problem. I was lucky to be part of a great team, working on a great problem, with great tools. Parallel TD [transient dynamics] continues to be an active area of research for Sandia and not all problems have been solved. Sandia’s progress to date in this area has generated international recognition for Sandia and DOE.” The computing platform used for this effort is the Department of Energy’s ASCI Red at Sandia National Laboratories.

Prototypical transient dynamics calculations are used to simulate car crashes; other applications in government and industry include simulations of metal-forming, explosions, and weapons effects. Steve is also the lead developer of Pronto3D, the first code to successfully combine finite element and gridless methods using parallel computing strategies. This code significantly expands the range of fluid-structure interaction problems that can be simulated.

The Gordon Bell Award

Led by the University of Chicago’s Center for Astrophysical Thermonuclear Flashes (an ASCI Alliance Center, see http://www.flash.uchicago.edu), a team that included Lawrence Livermore, Sandia, and Argonne national laboratories successfully concluded a three-dimensional simulation of the propagation of a detonation front through stellar materials, on the largest domain and at the finest spatial resolution studied to date. The team states that this problem is astrophysically important because it helps determine how a supernova explodes, and thus improves the understanding of the origin and evolution of the chemical elements involved.

From the scientists, engineers and staff in the ASCI Program...

HAPPY HOLIDAYS

In the News...

With Paul Messina’s departure, Bill Reed becomes Acting Director, Office of Advanced Simulation & Computing, DP/NNSA/DOE.

Upcoming Events...

Normal Environments External Review, Sandia Albuquerque, January 15-17, 2001

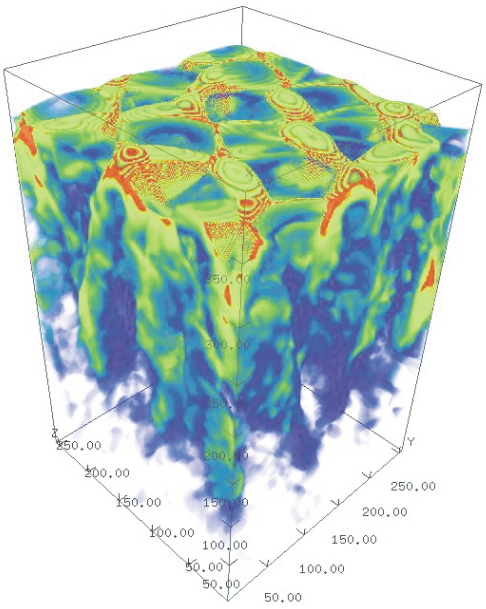
Secondary Burn Code Review, Lawrence Livermore, January 17-18, 2001

ASCI Principal Investigators Meeting, Los Alamos, January 22-25, 2001

The team's efforts were recognized with a Gordon Bell Award, presented at SC2000 in Dallas, Texas in November. The team successfully showed an efficient implementation of an adaptive mesh refinement package on massively parallel computers. Bruce Curtis, a member of the Center for Applied Scientific Computing at Lawrence Livermore National Laboratory, helped improve code performance.

Gordon Bell Prizes are awarded each year to recognize outstanding achievement in high-performance computing. The $5000 prize money is named for Gordon Bell, a senior researcher in Microsoft's Telepresence Research Group, a part of the Bay Area Research Center located in San Francisco, California. Bell is, himself, a pioneer in high-performance computing. One of the purposes of the award is to track the progress over time of parallel computing in applications.

The simulations for this work were performed on ASCI Red at Sandia National Laboratories using FLASH, a code developed at the Center for Astrophysical Thermonuclear Flashes at the University of Chicago. FLASH is a modular, adaptive mesh, parallel simulation code that can run compressible, reactive fluid flows in astrophysical environments. It achieved a sustained performance of 238 Gflop/s on 6420 of ASCI Red's processors. FLASH has also completed large simulations on Lawrence Livermore National Laboratory's ASCI Blue-Pacific system.

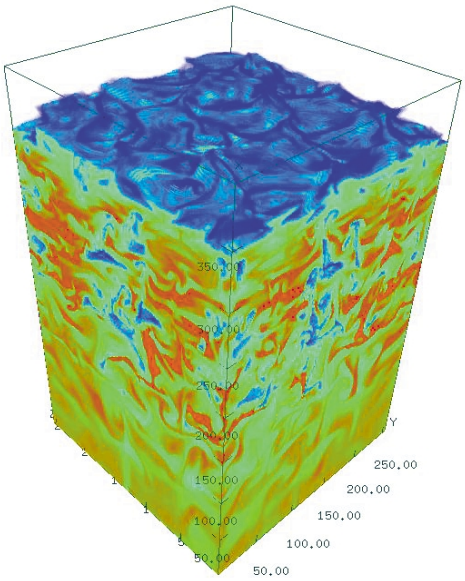


FLASH simulation showing pressure as a function of spatial resolution: 0.05 cm.

SIERRA Milestone

The SIERRA team at Sandia National Laboratories completed a major milestone for ASCI when it recently demonstrated the successful execution of the SIERRA framework on three Nuclear Weapon Complex ASCI platforms (Blue Mountain at Los Alamos, Blue Pacific at Lawrence Livermore, and Red at Sandia). With SIERRA, researchers are able to use the ASCI distributed computing environment to process remote jobs and post-process data using the ASCI visualization resources with only a single DOE authentication. This accomplishment impacts the entire ASCI program with algorithms, parallel input/output, fluid/structural/thermal mechanics, and problem decomposition and setup.

In addition, the SIERRA finite element solver interface scaled to more than 3000 processors. First-time achievements in the framework included support for H-adaptivity and coupling of multiphysics codes. The tasks associated with this milestone are, for the first time at Sandia, maintained and verified by the nightly regression tests executed on all three ASCI platforms. Sierra will continue to build on this capability and enhancements to Sierra will be applied to Defense Program applications.



FLASH simulation showing silicon as a function of spatial resolution: 0.05 cm.

The ASCI Update is written and published monthly by the Los Alamos, Sandia, and Lawrence Livermore national laboratories, with contributions from the Department of Energy. This newsletter, along with past editions, may be viewed on the web: www.sandia.gov/ASCI. Comments or inquires should be sent to ASCI@sandia.gov. SAND 2000-2828.